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(54) PROCESS FOR MAKING JOINING TAPES

(71) We, IMPERIAL CHEMICAL INDUSTRIES LIMITED of Imperial Chemical House, Millbank, London, S.W.1., a British Company do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a process for making joining tapes, especially carpet joining tapes used in joining carpet edges together.

British patent specification 979,283 describes a process for making carpet joining tapes in which a melt or solution of a polymer or copolymer of an olefin is applied to a surface of a tape by techniques such as roller coating or extrusion coating which ensure that a continous and homogenous coating is obtained. The apparatus necessary to carry out roller coating and extrusion coating, however, is expensive.

It is an object of this invention to provide a process for making joining tapes which can be carried out on relatively inexpensive apparatus and which provides an adequately continuous and homogenous coating.

Accordingly by this invention we provide a process for making joining tapes in which hot melt adhesive comprising a free flowing mixture of:

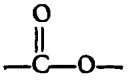
a) solid particles, capable of passing through a 500 micron mesh sieve of a tack resin; and

b) solid particles, capable of passing through a 500 micron mesh sieve, of a copolymer of ethylene with a co-monomer which contains within its molecule from 3 to 6 carbon atoms, a carboxy group (as hereinafter defined) and one carbon-to-carbon double bond; in which the ratio by weight of tack resin to ethylene copolymer is from 4:1 to 2:5,

is deposited onto one surface of a flexible material and subjected to heating from a heat source located above the surface, said heating being sufficient to fuse the hot melt adhesive and subsequently the tape is cooled so as to cause the fused hot melt adhesive to resolidify.

The tack resins used in this invention are a group of hard brittle resins which have softening points between 70 and 150° C. and which have the property of increasing the adhesiveness of the molten copolymer. The resins should be sufficiently hard and brittle to allow them to be ground into free flowing powders. Tack resins suitable for use in this invention include the rosin family of resins usually obtained from conifers and in particular fully or partially hydrogenated wood rosin esters made by esterifying with for example glycerol or pentaerythritol. Other tack resins which may be used include various coumarone-indene resins, petroleum derived hydrocarbon resins, permanently fusible phenolic resins, copolymers of α-methyl styrene with vinyl toluene, the materials described as "formolite resins" in British Patent 1 116 551 and the polydiene resins discussed in the article "Hydrocarbon Resins in Paper Coatings" in Volume 53 No. 5 of 'Industrial and Engineering Chemistry' pages 371 to 374 (May 1961). Our preferred tack resins are the glycerol and pentaerythritol esters of hydrogenated wood rosins.

The ethylene copolymers used in this invention are copolymers of ethylene with comonomers containing at least three and not more than six carbon atoms in the molecule and the monomer molecule also contains a carboxy group, that is to say the group represented as



and one carbon to carbon double bond. Examples of such comonomers are vinyl acetate, acrylic acid, methacrylic acid and lower alkyl esters of acrylic acid and methacrylic acid. Hydroxyethyl methacrylate is also an example of this type of comonomer. The copolymers preferably contain from 60 to 85% by weight of coplymerised ethylene and when the comonomer is vinyl acetate it is preferred to use copolymers containing from 15 to 30% by weight of vinyl acetate. The copolymers should have a melt flow index of 1 to 1000, and preferably of 1 to 40.

The ethylene copoloymers used in this invention may be powdered using any of the conventional techniques employed to grind high pressure ethylene polymers. For example they may be ground in a Pallman mill. It is important to use a grinding method in which the temperature of the grist can be controlled. The tack resins may also be ground in a Pallmann mill or by crushing in a hammer mill or similar impact device. Oversize particles are excluded by sieving.

The tack resin and the copolymer, can be admixed by a simple tumble blending operation, but it is preferred to use the more thorough admixing action of a fluidising mixer such as a Henschel mixer.

The free flowing hot melt adhesive thus made may then be applied to the surface of the flexible material by any suitable means capable of depositing it evenly over the surface. For example particles of the hot melt adhesive can be sprinkled over the surface by use of a vibrating hopper fitted with a brush which rotates within the hopper throat. Deposition may also be effected by means of particles carried in an air blast.

The flexible material and its deposited covering of hot melt adhesive are subjected to heating from a heat source above the surface of the tape, usually by passing through an oven or under radiant heaters. The duration and intensity of the heating is determined by several factors such as the tack resin chosen, the roughness of the surface of the flexible material and in particular by the size of the particles of the mixture. We prefer to subject the deposited hot melt adhesive to temperatures of from 70 to 150° C. for periods of from 2 to 15 minutes. However, the finer the particles, the shorter is the heating period. The particles should be capable of passing through a sieve having a mesh of about 500 microns and in fact a convenient standard sieve to use is that described in A.S.T.M. Specification E11—61 and designated "Sieve Number 35".

Alternatively or additionally the hot melt adhesive may be subjected to heat as it is deposited onto the surface of the flexible material. For example, if the hot melt adhesive is deposited from a vibrating hopper it can be made to fall between radiant heaters so that by the time it has fallen onto the surface of the flexible material it is already in a fused or partially fused condition.

In addition to comprising tack resin powder and the copolymer powder, the hot melt adhesive may also optionally comprise other particles of other powdered materials such as waxes (including synthetic waxes) and fillers. In particular the mixture may contain up to 60% by weight (based on the total weight of the tack resin and ethylene copolymer) of a petroleum wax such as paraffin wax. Such waxes increase the spreading power and degree of penetration of the bonding layers obtained on fusing the deposited mixture. Preferably the size of the particles of filler and the wax powder should be similar to that of the particles of the tack resin and copolymer. However, the ease with which petroleum waxes melt permits some lattitude so that wax powders capable of passing through a standard 707 micron sieve (Sieve Number 25) are useful. A convenient way of making the wax powder is by simply crushing the wax into a powder comprising tiny flakes. The wax powder may be conveniently admixed with the other components of the mixture during a tumble blending or Henschel mixing operation.

The hot melt adhesive mixture may also contain particles of powdered inorganic fillers such as talc, chalk, whiting, clay, silica, dolomite, titanium dioxide or barium sulphate. Such fillers both cheapen the hot melt adhesive and are also useful when it is desired to impart an increased stiffness to the final bonding obtained. The particles of filler shrould also be capable of passing through Sieve Number 35. The filler may be present in amounts of up to 30% by weight (based on the total weight of the tack resin and ethylene copolymer) but we prefer to use amounts of 15 to 20%. Again the fillers may be conveniently admixed with the other components of the hot melt adhesive during tumble blending or Henschel mixing.

It is a further feature of this invention to use hot melt adhesives containing up to 5% by weight (based on the total weight of the tack resin and ethylene copolymer) of a powdered foaming agent such as N,N' - dimethyl - N,N'-dinitrosoterephthalimide or p,p' - oxybis(benzenesulphonhydrazide) so as to produce a foamed coating of hot melt adhesive. However most blowing agents which are suitable for use at the temperature to which the hot melt adhesive is subjected are expected to be satisfactory. If it is desired to make a stronger foam then the mixture may also contain up to 5% (based on the total weight of the tack resin and ethylene copolymer) of a cross-linking agent for ethylene polymers suitable for use at the temperatures to which the joining tape is subjected when it is being used, for example to join together two carpet edges. The cross-

linking agent may be dicumyl peroxide or 1,3-bis(α,α - dimethyl - 2 - butylperoxymethyl)benzene.

An advantage of joining tapes made according to this invention is that they are easily stored being non-adhesive at ambient temperatures and yet they are easily made adhesive by the application of heat, for example by means of a domestic iron. Suitable flexible materials used in making carpet joining tapes include hessian, polyolefin film especially polypropylene film, woven synthetic fibres such as nylons, 'Terylene' (Registered Trade Mark of Imperial Chemical Industries Ltd.) or polypropylene fibre and felts such as 'Terylene' felt.

The following examples serve to illustrate the invention.

Examples 1 to 8

Various hot melt adhesives were made by admixing in a Henschel mixer the various proportions of components as set out in the tables 1 and 2. In all the examples the components were powders capable of passing through Sieve Number 35.

The hot melt adhesives were transferred from the mixer to a vibrating hopper of the kind fitted with a rotating brush in its throat which sprinkled the powder evenly over the surface of a 'Terylene' felt at a rate such that 15 ounces per square yard (0.5 gk/m^2) of composition were sprinkled onto the felt. The felt was then passed into an oven maintained at 140° C. The felt remained in the oven for 10 minutes and was then removed and cooled to room temperature. In all the examples it was found that the composition had fused into a bonded layer which adhered satisfactorily to the felt.

TABLE 1

Example	Parts by weight of EVA copolymer added to mixer			Tack Resin Chosen
		% Vinyl Acetate	Melt Flow Index	
1	50	28	5	Pentaerythritol ester of fully hydrogenated wood rosin
2	25	28	5	"
3	49	28	5	"
4	49	28	5	"
5	25	24	20	"
6	40	24	20	"
7	49	28	5	Glycerol ester of a fully hydrogenated wood rosin
8	70	28	5	Styrene copolymer
9	50	18	33	Glycerol ester of a fully hydrogenated wood rosin

TABLE 2

Table continued

Example	Parts by weight of tack resin added to mixer	Filler Chosen	Parts by weight of filler added to mixer	Blowing Agent Chosen	Parts by weight of blowing agent added to mixer
1	50	—	—	—	—
2	55	Chalk	20	—	—
3	48	—	—	N,N'-di-methyl-N,N' dinitroso tere-phthalimide	3
4	49	—	—	„	2
5	55	Chalk	20	—	—
6	60	—	—	—	—
7	48	Talc	3	—	—
8	30	—	—	—	—
9	50	—	—	—	—

In all the examples the copolymers were copolymers of ethylene with vinyl acetate in percentages by weight (based on the total weight of the copolymer) as specified in the table. The melt flow index as determined by A.S.T.M. test 1238—67 using a 2.16 kg weight at 190° C. is also given in the table. The copolymer had been ground by an impact and smearing process using a Pallmann mill. The tack resin was ground by using a hammer mill at 80° C. The other additives were commercially available as powders of a suitable particle size.

The coated felts of the above examples were suitable for use as carpet joining tapes, being made adhesive by the application of heat from a domestic iron.

WHAT WE CLAIM IS:—

1. A process for making joining tapes in which hot melt adhesive comprising a free flowing mixture of:

a) solid particles, capable of passing through a 500 micron mesh sieve, of a tack resin; and

b) solid particles, capable of passing through a 500 micron mesh sieve, of a copolymer of ethylene with a comonomer which contains within its molecule from 3 to 6 carbon atoms, a carboxy group and one carbon to carbon double bond; in which the ratio by weight of tack resin to ethylene copolymer is from 4:1 to 2:5,

is deposited onto one surface of a flexible material and subjected to heating from a heat source located above the surface said heating being sufficient to fuse the hot melt adhesive; and subsequently the tape is cooled so as to cause the fused hot melt adhesive to resolidify.

2. A process according to claim 1 wherein the copolymer is a copolymer of ethylene with vinyl acetate.

3. A process according to either claim 1 or claim 2 wherein the hot melt adhesive comprises up to 60% by weight (based on the total weight of the tack resin and ethylene copolymer) of particles, capable of passing through a 707 micron sieve of a petroleum wax.

4. A process according to any one of claims 1 to 3 wherein the hot melt adhesive comprises up to 30% by weight (based on the total weight of the tack resin and ethylene copolymer) of particles, capable of passing through a 500 micron sieve, of a powdered inorganic filler.

5. A process according to any one of claims 1 to 4 wherein the hot melt adhesive comprises up to 5% by weight (based on the total weight of the tack resin and ethylene copolymer) of a foaming agent.

6. A process according to claim 5 wherein the hot melt adhesive comprises up to 5% by weight (based on the total weight of the tack resin and ethylene copolymer) of a cross-linking agent for ethylene polymers.

7. A process for making joining tapes according to claim 1, substantially as hereinbefore described with reference to the foregoing examples.

8. Joining tapes whenever made by a process as claimed in any one of claims 1 to 7.

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